

**ABSTRACT**

5      A joint (32) having bond line grains (28) that nucleate in the joint region (32) and grow into the adjoined solid substrates (12, 14). The resulting bond line grains have a size that is greater than a thickness (T) of a molten region (15). The surfaces of the substrates are cold worked to a desired degree of residual stress prior to the bonding process so that the recrystallization of the substrate surface necessary for the grains to grow into the substrates results in a reduction in the local free energy.